National Aeronautics and Space Administration

MARSHALL STAR

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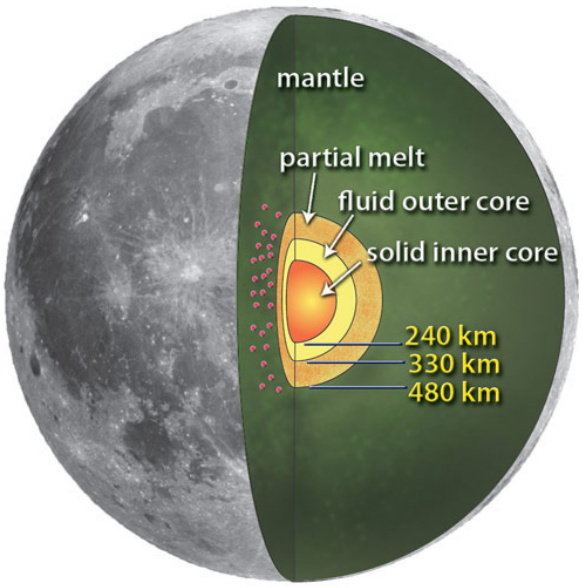
NASA, academic researchers apply 21st-century technology to 20th-century data to reveal moon's Earth-like core



An artist's rendering of the lunar core as identified in new findings by a NASA-led research team.

By Rick Smith

A NASA-led research team has applied state-of-the-art seismological techniques to a wealth of Apollo-era data to credibly detect what scientists have surmised for years: Our moon has a core, the team reports, not unlike that of Earth's own core.

The discovery was made by a team of scientists from the Marshall Space Flight Center; Arizona State University in Tempe; the University of California at Santa Cruz; and the Institut de Physique du Globe de Paris in France. Their findings have been announced today in a paper published in the online edition of "Science," the journal of the American Association for the Advancement of Science.

According to the team's findings, the moon possesses a solid, iron-rich inner core with a radius of nearly 150 miles and a fluid, primarily liquid-iron outer core with a radius of roughly 205 miles. Where it differs from Earth is its partially molten boundary layer around the core, estimated to have a radius of nearly 300 miles.

Nonetheless, the team concluded: "The deepest interior of the moon

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Shuttle Discovery to launch no earlier than Feb. 24

By Sanda Martel

Space shuttle Discovery will launch on its STS-133 mission no earlier than Feb. 24, NASA managers announced at a news conference from Johnson Space Center in Houston on Jan. 11. Shuttle managers have not yet selected a target date for the mission because the schedule depends in part on traffic

*See **STS-133** on page 5*

Center director's all-hands meeting rescheduled for Jan. 14 at 10 a.m.

The all-hands meeting with Marshall Center Director Robert Lightfoot has been rescheduled for 10 a.m., Jan. 14, in Morris Auditorium, Building 4200.

Lightfoot will discuss the latest status of NASA's budget process and its significance to the center. The event will be aired on Marshall TV and Desktop TV.

Bus transportation to Morris Auditorium will be available with a schedule forthcoming. All center employees – civil service and on-site contractors – are encouraged to attend.

Robert Lightfoot

Paige Vaughn, May Wales win seats on NASA Exchange Council

Paige Vaughn and May Wales have been elected to two-year terms on Marshall Space Flight Center's NASA Exchange Council by civil service employees.

Vaughn is a support services specialist in the Science & Mission Systems Office, and Wales is a lead program specialist in the Office of Strategic Analysis & Communications.

The new council members, who joined seven others Jan. 1, will help provide leadership and direction for the Exchange. Council member duties include assisting with development of new Exchange policies and programs, voting on request of money or services from the Exchange, as well as developing new business opportunities. The Exchange also funds centerwide events such as the annual picnic and the holiday reception.

To learn more, visit http://exchange.msfc.nasa.gov/.

Paige Vaughn

May Wales

Training for new Marshall Form 4554 'Transfer and Shipping Document' to be held Jan. 19-20

The Marshall Space Flight Center's Logistics Service Office, in cooperation with our civilian and contractor stakeholder community, has developed a new Marshall Form 4554 "Transfer and Shipping Document (MSFC Replacement for DD1149)" that should be used in lieu of the DD Form 1149 "Requisition and Invoice/ Shipping Document."

The Logistics Services Office will host three live demo presentations, with questions and answers to review the new form. The schedule for presentations is Jan. 19 from 8 to 10 a.m., and Jan. 20 from 9 to 11 a.m., and from noon to 2 p.m., in Building 4200, Room 409.

To reserve your space, please contact Richard Robbins at richard.e.robbins@nasa.gov or call 544-0363.

The Logistics Office sought to develop a "smart" form that had optimum electronic capabilities – to include electronic signatures and understandable instructions. Broad implementation and use of the Marshall 1149 Form are anticipated to eliminate some of the interruptions to work flow that have occurred in the past and to move closer to a more efficient, standardized form/process for property transfers. A live overview demonstration of the form was recently provided to Headquarters. The scheduled release date for the new form is in January.

Entries now being accepted for the '11 Earth Day logo contest

The Environmental Excellence Team committee is accepting entries through Feb. 1 for the 2011 Earth Day logo contest.

The logo design entries should reflect this year's theme and slogan. The theme is "Sustainability" with the slogan "Living Green – Easy as ABC."

The winning logo will be used in promotional materials for Earth Day and as the design for the Earth Day T-shirt. Only hand-drawn sketches will be accepted. The contest is open to civil service and contractor employees and their children.

For rules and directions for submitting entries, visit http://inside.msfc.nasa.gov/announcements/ed-logo-entry.html.

For more information, contact Ashley Boudreaux at ashley.e.boudreaux@nasa.gov or 544-5573.

Caring in Action Program Recipient of the Month

Kinworthy stops X-ray operation before team member exposed to radiation

Allen Kinworthy, an engineer for All Points Logistics Inc., supporting the Marshall Space Flight Center Engineering Directorate, has been selected the Caring in Action Program Recipient of the Month.

Kinworthy spotted a team member on the roof of Building 4702, unaware that an X-ray operation was scheduled to begin. "When the X-ray warning sequence started, Allen Kinworthy rushed to the control area and stopped the procedure before the worker was exposed to dangerous radiation," said Glenda Morton, Safety Action Team chairwoman.

For more information about the Caring in Action Program or to nominate a team member, visit https://safety.msfc.nasa.gov/sites/cia/.

Allen Kinworthy, left, receives the Caring in Action Program Recipient of the Month award from Glenda Morton during a recent Marshall senior staff meeting.

Moon *Continued from page 1*

has considerable structural similarities with the Earth." Their studies indicate the core contains a small percentage of light elements such as sulfur, echoing new seismology research on Earth that suggests the presence of light elements – sulfur, oxygen and others – in a layer around our own core.

Lead researcher Dr. Renee Weber, a NASA space scientist at the Marshall Center, said the team used extensive data gathered during the Apollo-era moon missions. That included years' worth of information about moonquakes – seismic shudders possibly caused by the buildup of Earth's tidal forces on and within the moon – collected by the Apollo Passive Seismic Experiment, four seismometers deployed between 1969 and 1972, which recorded continuous lunar seismic activity until late 1977.

"We applied tried and true methodologies from terrestrial seismology to this legacy data set to present the first-ever direct detection of the moon's core," Weber said.

Whereas sophisticated satellite imaging missions to the moon recently have made significant contributions to the study of its history and topography, the deep interior of Earth's sole natural satellite primarily had remained a subject of speculation and conjecture since the Apollo era, she said. Researchers previously had inferred the existence of a core, based on indirect estimates of the moon's interior properties, but many disagreed about its radius, state and composition.

Such hard data is critical for developing accurate models of the moon's formation and evolution, and for shedding light on the history of a lunar dynamo – the natural process by which our moon may once have generated and maintained a strong magnetic field of its own.

The team analyzed Apollo lunar seismograms using array processing methods – signal processing techniques that identify and distinguish signal sources of moonquakes and other seismic activity. The team identified how and where seismic waves passed through or were reflected by elements of the moon's interior, signifying the composition and state of layer interfaces at varying depths.

A primary limitation to past lunar seismic studies was the wash of signal "noise" caused by overlapping signals bouncing repeatedly off structures in the moon's fractionated crust. To mitigate this challenge, Weber and the team employed an approach called seismogram stacking, or the digital partitioning of signals. Stacking improved the signal-to-noise ratio and enabled the researchers to more clearly track the path and behavior of each unique signal as it passed through the lunar interior.

Weber said her team is excited about its findings, but the work continues. "We hope to continue working with the Apollo seismic data to further refine our estimates of core properties, and also to characterize lunar signals as clearly as possible to aid in the interpretation of data returned from future missions," she said.

To read the team's complete paper on the lunar core, visit http://www.sciencemag.org/.

For more information about NASA science exploration missions, visit http://www.nasa.gov/topics/moonmars.

Smith, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis and Communications.

Classified Ads

To submit a classified ad to the Marshall Star, go to Inside Marshall, to "Employee Resources," and click on "Marshall Star Ad Form." Ads are limited to 15 words, including contact numbers. No sales pitches. Deadline for the next issue, Jan. 20, is 4:30 p.m. Thursday, Jan. 13.

Miscellaneous

UAH books for sale, new when bought, will sell below used prices. 256 489-6143

Kirby vacuum cleaner with shampooer, $250. 256-509-7999

Three-stone diamond ring, 1.5 carat TW, $3,285. 256-658-3960

New violin, case. 256-426-5042

Art deco waterfall cedar chest, $125. 256-882-3895

Netgear N300 wireless dual-band router, $20. 256-518-9869

Medela Freestyle breast pump, hands free, battery/AC operated, cold pack, bottles, valves, other accessories. 256-476-5836

King-size furniture, Mediterranean triple dresser, mirror, chest of drawers, nightstand, $200. 256-353-4922

DCI Titleist irons 3-PW, SW & LW, $225. 256-881-5642

Playstation 3 slim 160GB, $275; Playstation 3 regular 80GB, $255. 256-975-9497

Bowflex Xtreme SE home gym, all books, all pieces, workout plan, $650. 256-606-5282

Large room rug, made in Egypt, Size 8' x 11', burgundy, green, beige, $400. 256-714-3768

Casio Privia PX-100 keyboard, stand, foot pedal, power supply, $150. 256-603-4438

Kasson pool table, fruitwood, Queen Anne feet, leather pockets, $1,950. 256-880-6563 leave message

Commercial-size Montego Bay tanning bed; Model 24E-canopy. 256-609-7259

Fischer Dutchess 8-foot pool table, accessories, Ping Pong tabletop add-on, $1,500. 256-426-6026

Washer/dryer, $300. 256-652-6233

iPod Touch, 3rd Generation, 32GB new replacement from Apple, $195 obo. 256-457-5823

Antique canning jars with wire bales, pints, quarts, $6 per dozen. 256-881-5860

Amcor 10,000 BTU Portable AC/Heater AL, 10,000EH for up to 300 sq ft, 115V/60Hz, $275. 256-679-2875

Weber kettle grill, $45. 256-783-3128

Couch, loveseat, recliner, coffee table, two end tables, $400. 256-658-0171

Oak entertainment center, picture at http://home.mchsi.com/~jscottm/tvstand.html, $400. 256-828-9651

Nine-foot pre-lit Christmas tree, $150; JVC miniDV camcorder, $75. 256-337-7943

Bowflex Xtreme2, $600. 256-612-7729

Twin bedroom suit, triple dresser, mirror, chest of drawers, end table, mattresses, boxsprings, $600. 256-881-5860

BOWFLEX Xtreme, $300 or best offer. 256-883-7851

Twin/full wooden bunkbed, pillowtop mattress, $350. 256-975-0227

Silver, 100 oz., $3,000 obo. 256-656-7997

Rustic pine end tables, coffee table, pic available, $75. 256-777-1810

Porta Power air compressor, 20 gallon, 135 PSI, $120. 256-852-6952

Wallpaper wall mural, sunroom garden, measures 6'Wx8'4"H, $30 obo. 256-679-3921

Pro-form C55 stationary recumbent cycle trainer, variable settings, $200. 256-325-9264

Ithaca Lefever 12 12GA, Glock 26 with crimson trace, Beretta 92FS, Winchester Model 12-20GA. 256-830-5663

Leather sofa, green, $900; Ekornes leather recliner, green, $600; Lafer leather exec recliner, $400. 256-715-0534

Weslo Pursuit R4.8 recumbent bike, pictures available, $175. 256-837-2848

Proform Crosswalk treadmill, space saver, power incline, joint protection system, $150. 256-565-9240

Wedding dress, size 20, brand new with tags, not altered, ivory, spaghetti straps. 256-659-6164

Toshiba satellite P105-S6197 1.6GHz, 320GB, 4GB Ram, XP&Ubuntu, $300. 256-457-5823

Sears Kenmore compactor, model 13605790, black, $200 obo. 256-653-7308

Playstation 3 game, Little BIG Planet, Game of the Year edition, rated Everyone, $25. 256-828-1234

Bowflex XL, leg attachment, $375. 256-880-7305

Vehicles

2010 Ford F150 XLT Supercrew, silver exterior, gray interior, 5,500 miles, $24,000. 256-318-0078 or 256-895-0577

2007 Nissan Sentra S, dark blue, gray cloth interior, 68k miles, $9,500. 931-625-1144

2007 Honda Civic, four door, auto, new tires/brakes, 62k miles, $12,000. 256-829-1296

2007 Honda CRF 450 X. 256-503-6812

2005 Yamaha Kodiak 450, $4,800; 2005 Kubota MX500DT, attachments, both very low hours, $22,000. 850-642-1553

2002 Chrysler Town & Country 3.8 Lxi, white/beige leather, loaded, transmission issue, 136,900 miles, $1,995. 256-656-4203

2001 Honda CR-V EX, manual, green exterior, gray cloth interior, 59k miles, $8,400. 256-830-0248 evenings

2000 Honda CRV LX, 4WD, 150k miles, $5,300. 256-533-7234

1999 GMC Denali, 4WD, 159k miles. 256-617-1936

1977 Ford F-100, V-6, white, straight shift, $1,500. 256-653-5992

1996 Avalon, 315k miles, rough interior, some body damage, $1,000 obo. 256-468-8708

1996 Roadtreck camper van, 350 generator, toilet, microwave, tv, air, hitch, awning. 256-572-0646

1994 Honda Accord LX, dark green exterior, tan interior, 268k miles, $1,750. 256-355-8530

1992 Bronco, 67k miles, $8,500; 1997 Pathfinder LE, 189k miles, $4,000; AR15 complete lower, $300. 256-658-8241

1990 Ford F-150 lariat, 74k miles, $1,700 obo. 256-617-1936

1985 Ford F-150, 4WD, short wheelbase, hunter green, tan interior, $2,950. 256-259-1523

Wanted

Students interested in obtaining beginner to advanced scuba diver certification. 256-651-9909

Parties to cater, specializing in wings. 256-783-9186

Mason or Ball canning jars, good condition. 931-625-7960

STS-133 *Continued from page 1*

at the International Space Station. A European cargo spacecraft, ATV-2, is scheduled to launch to the space station Feb. 15 to deliver supplies and equipment to the orbiting outpost.

Shuttle Discovery remains in the Vehicle Assembly Building at Kennedy Space Center, Fla., as modifications and repairs continue on the external fuel tank's support beams known as "stringers," which are 21-foot-long, U-shaped aluminum brackets located on the intertank. Additional support structures called radius blocks will be added to all 108 stringers, meaning the entire circumference of the external tank will be strengthened by the time all the repairs and modifications are finished. The radius blocks are 6-inch by 1/5 inch by ¾ inch aluminum which will be attached over the feet of the stringers.

"It's been a long road," said John Shannon, Space Shuttle Program manager. "I'm very confident we have finally figured it out and we have a fix. We're going to fly with a lot of confidence in this tank."

Small cracks developed on the exterior of the external tank in an area known as the intertank during the Nov. 5 launch attempt of Discovery. Additional cracks were found through X-ray image scans of the backside of the tank after the shuttle was returned to the Vehicle Assembly Building at Kennedy on Dec. 22. The cracks were located on the tops of 21-foot-long stringers.

Teams at the Marshall Space Flight Center and NASA's Michoud Assembly Facility in New Orleans have worked on the stringer problem, the testing and the required fixes, which includes reinforcing the stringers with radius blocks.

"This was a tough problem and the Marshall and Michoud teams did a terrific job," said Shannon.

The external tank repairs have been briefed to NASA leadership and everyone agrees that the required repairs will bring the tank to 100 percent, said Shannon.

Kennedy technicians continue repair work to space shuttle Discovery's external tank.

Shuttle Endeavour's STS-134 launch is now targeted for April 1, or April 18 if managers decide to perform a tanking test and X-rays of the shuttle's external tank.

Bill Gerstenmaier, associate administrator for Space Operations at NASA Headquarters in Washington, also said that the possible last mission, previously referred to as STS-335 – the designation for the launch-on-need mission for STS-134 – now will be referred to as STS-135, meaning that the team is "mentally shifting gears to think of it as a real flight, to ensure we're not missing anything from a manifest standpoint." Managers will continue looking at staffing, budget and other issues which will determine if STS-135 will launch.

"We have the budget to get through April with margin and get close to a June flight (for STS-135)," Gerstenmaier said. "But we'll need to see what happens with Congress and the June flight."

Martel, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis and Communications.

Obituaries

Edward Mallory, 79, of Madison died Dec. 14. He retired from the Marshall Center in 1995 as an experimental facilities development engineer. He is survived by his wife, Marilyn Mallory.

Chieko Oguro Inman, 76, of Huntsville died Dec. 22. She retired from the Marshall Center in 2003 as a visual information specialist.

David L. Shipman, 79, of Huntsville died Dec. 27. He retired from the Marshall Center in 1990 as an aerospace engineer. He is survived by his wife, Sandra R. Shipman.

Kathleen Biel Freestone, 41, of Madison died Dec. 29. She was a computer engineer in the RF & Data Systems Branch of the Engineering Directorate. She is survived by her husband, Todd Freestone.

James Lowe, 94, of Panama City Beach, Fla., died Dec. 26. He retired from the Marshall Center in 1970 as an illustrator editor.

Robert Coulter, 80, of Huntsville died Dec. 28. He retired from the Marshall Center in 1990 as an engineer.

Richard Poorman, 87, of Arab died Dec. 28. He retired from the Marshall Center in 1994 as an aerospace engineer.

Carl Edward Colley, 75, of Decatur died Jan. 3. He retired from the Marshall Center in 1990 as an aerospace engineer supervisor.

Carolyn Thompson Spray, 64, of Fayetteville, Tenn., died Jan. 3. She retired from the Marshall Center in 1995 as a program analyst.

For a healthier 2011

7th annual Weigh to Win competition begins Jan. 24

Is your New Year's resolution to get fit? Join the seventh annual Weigh to Win competition at the Marshall Space Flight Center's Wellness Center!

Teams of five will compete Jan. 24 to March 18 to lose the most weight. "In an initiative toward a healthier NASA community in 2011, this program is fun and motivating to all who participate," said Michael Clark, an exercise specialist for Marshall's NASA Exchange, supporting the Office of Human Capital. "Health and fitness professionals are on staff to help contestants begin an exercise program and track their progress, while providing an educational aspect that teaches individuals how to eat and exercise properly."

The cost to join the contest is $5. Prizes will be awarded to the first-, second- and third-place teams, and individual prizes will be given to the winning male and female contestants.

Participants are encouraged to attend a nutrition seminar to be presented by registered dietician Tammy Beasley on Feb. 3 at 11:15 a.m. in Morris Auditorium, Building 4200. The seminar gives listeners the tools to optimize nutritional requirements and speed up their metabolism without drugs or dramatically changing the foods they love.

"Based on the success and feedback from past competitions, the Wellness Center is looking forward to great participation this year," said Clark.

Registration dates are Jan. 12-18 at the Wellness Center. For more information, contact Clark at 544-3337.

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